

the activity and utility of its members. It is true that very many of these are obtained from the surface of the sea and not strictly from the shore, but that same remark applies equally to the medusoids discussed and figured in Chapter iii., and it would be difficult to catch the medusoids without seeing Copepoda also. But there are also plenty of shore-haunting copepods to be obtained very easily with a muslin hand-net in pools, or from sand and mud at low tide, and under stones. A small boy of six has just brought me a cup full of bright red ones (*Harpacticus fulvus*) which he caught himself with a sixpenny hand-net along the edge of the sea and in pools, where they are quite visible to the eye. He wanted to know what they were and how they jumped, and his little sister of two-and-a-half added the important question, "Why are they so red?" If Miss Newbigin would answer these questions—and no one is more competent than she to deal with the last one—it would help not only the children, but their seniors. *Harpacticus* is sometimes very abundant in pools far up the shore, where their red bodies are quite conspicuous on the green *Enteromorpha*, and they are eaten with avidity by young blennies, sticklebacks and other little shore fishes. "Why are they so red?"¹

The "keys for identification" and other similar tables of characters at the ends of chapters are of doubtful utility. They are, of course, incomplete; they only deal with a few selected genera and species in each section, and yet from their form they give the deceptive impression of a complete classification; they lead to a good deal of repetition and give little information beyond what is in the text—a considerable saving of space would be effected by their removal. What is the difference between "legs very slender and long" given as a character of *Phoxichilidium*, and "legs very long and slender" as a character of *Nymphon* in the table on p. 224?

Dissection of the types chosen and details of internal structure have, probably quite wisely, been avoided; but under those circumstances some statements in the book, such as that "the heart is in front of the gill" (p. 248) given as a character of the opisthobranchs, will probably be found meaningless to readers without further knowledge than the book gives. Even one simple anatomical diagram of the type form of each group would have been a useful addition.

There are, of course, other points of detail in connection with which alterations might be suggested. *Asterina gibbosa*, very common in shore pools amongst *Corallina* on some parts of the coast, might be added to the starfishes discussed. The presence of thread-cells in the cerata of *Eolis* is an interesting point worthy of mention. *Trochus zizyphinus* (p. 236) is not merely an inhabitant of deep water, but is common, alive, between tide-marks on some of our shores. On the whole the figures are good, but *Alcyonium* (p. 16), *Polycarpa* (p. 295) and *Pleurobrachia* (p. 330) are not satisfactory.

The style of the book is easy and pleasing—lively even in places, as on p. 277, where the author describes how she first made acquaintance with the grace and beauty of the living *Lima hians* when released from its woven nest of shells and weeds. In conclusion, it is a pleasure to

cordially recommend "Life by the Sea-shore" as a charming and useful holiday companion which will not only give much information, but will also serve as a good introduction to one of the most fascinating branches of modern science.

W. A. HERDMAN.

SCIENTIFIC TOPOGRAPHY.

Recherches sur les instruments, les méthodes et le dessin Topographiques. By Colonel A. Laussedat. Tome ii. Part i. Pp. 198. (Paris: Gauthier-Villars et Fils, 1901.)

IN the first part of the second volume of his exhaustive treatise on topography, Colonel Laussedat treats of "iconométrie" and "métrophotographie"—two branches of the art which are but little studied in British military schools. He commences by tracing the evolution of the photo-theodolite from the primitive forms of the camera obscura and the camera lucida; and not the least instructive part of this volume is to be found in the careful analysis of those principles of perspective which are the governing principles of all methods of reducing a field of observation to its horizontal plan, whether for the purpose of topography or of plan drawing. He shows that the camera lucida is an instrument which (in France at any rate) has proved of immense value in the hands of the military engineer. Some excellent examples are given by Colonel Laussedat of the practical use that has been made of this instrument in the construction of accurate geometrical views of fortifications, with the object of obtaining precise plans of the same, on the principle which was first advocated by Beautemps-Beaupré, and which is fully explained by the author. It is curious that an English invention (it was invented in 1804 by Wollaston) should have been applied to so much greater practical purpose in France than it ever has been in England.

From camera lucida drawings of the elevation of a line of fortifications, or of buildings taken from two or more points of view, French engineers have found it possible to construct accurate plans of the same fortifications on precisely the same principles which now lead to the definition of topography from photographs. With this instrument, combined with a telescopic enlargement of the field of view, the defenders of Paris during the last memorable siege were able to construct a fairly accurate panorama of the German advanced positions around the city, to note the daily and hourly changes in those positions, and to keep the military authorities perpetually supplied with most important information which would otherwise have been impossible to attain. In his concluding chapter Colonel Laussedat renders a well-deserved tribute of recognition to those many assistants (astronomers, doctors, engineers, artists and architects) who all brought the necessary technical artistic skill to his assistance and maintained that remarkable record. In England the camera lucida is still recognised as an important aid to the illustration of geological phenomena. But its capabilities as a military instrument have been hardly recognised.

From the camera lucida to the photo-theodolite is a natural process of evolution, and the best half of the volume is devoted to its illustration. The application of photography to surveying has already been well tested

¹ Obviously, there are two kinds of answer—the one in terms of lipochromes and the other in terms of natural selection.

in many European fields, as well as in America. Some tentative efforts are now being made to introduce the photo-theodolite to India, but the results are hardly mature enough to justify any opinion as to their success. In France photo-topography has been chiefly applied to the field of that which we should term in England "revenue" or "cadastral" survey; and in Canada (a fact which is not recognised by Colonel Laussedat) a still wider opening has been afforded by the Geological Survey, which is practically a small scale topographical survey leading to the first general map of the country. There are, at any rate, records sufficient to enable us to bring the test of actual experience in other countries than France to bear on Colonel Laussedat's estimate of the capabilities of the system. That estimate appears to be absolutely favourable, but it must be contended that the illustrations which support Colonel Laussedat's opinion are not in themselves comprehensive enough to justify the conclusions at which he arrives, which would apparently include all classes of reconnaissance, or survey; in all conditions of ground as suitable for its application.

An official examination into the results of a photo-theodolite survey was conducted in Paris as long ago as the year 1859, and the report of the commissioners nominated by the Academy of Sciences was so favourable that in 1863 a "photo-topographic brigade" was formed, under the direction of Laussedat, which executed surveys on comparatively large scales (from 1/1000 to 1/20000), and which lasted for a period of eight years. The brigade was broken up in 1871, and whilst Colonel Laussedat refrains from commenting on the reasons for its suppression, he clearly indicates that it was for no reason which implied technical failure.

Various modifications of the original system are discussed or recommended, and one or two excellent illustrations of the resulting surveys are given at the end of the book. But it must be noted that the field of survey to which this process has been applied in France is after all but local, and the scale of mapping is comparatively large. For instance, we find in Plate xiii. a reproduction of about 15 square miles of country, originally surveyed on a scale approximating to 12 inches per mile (reduced to one-fourth in reproduction), to which the following details are appended. The survey was completed in ten days in the field, supplemented by two and a half months of subsequent work in the drawing office (bureau). It involved the use of fifty-two photographs, which were taken at thirty-one stations. Of these stations eighteen were stations of triangulation, and the rest "supplementary." The map itself is fully contoured and apparently quite up to the standard, in detail, of maps on a similar scale executed by the English Ordnance Survey. The time (and consequently the expense) involved in its production will of course compare favourably with that of any other known system of surveying; but it would be rash to infer therefrom that photo-topography is under all conditions either a cheap or a rapid method of surveying. In Canada good work has been done by this process on the smaller scales of one inch or two inches per mile, and the system generally is well established. But Canadian surveyors are not prepared to advocate it in entire supersession of the more widely known system of plane

table topography based on triangulation, maintaining that its advantages are confined to comparatively restricted conditions of surface conformation. Thirty-one stations of observation in fifteen square miles of country (giving an average of two "fixings" per square mile) may under certain conditions be sufficient to enable a surveyor to see into the topographical detail of ridge and furrow, plain and gully, that the country presents, and result in a creditable map. But in a vast proportion of the broken and rugged districts presented by the varied physiography of Asia, Africa, or America two stations per mile would certainly not be sufficient, and the accumulation of photographs would rapidly become an unwieldy burden. When we consider the requirements of geographical surveys on yet smaller scales (say 1/500000) it is impossible to concede that the recognised systems of rapid plane tabling in experienced hands, which result in daily outturns which may be reckoned in scores of square miles of finished mapping (no "bureau" work is required by a really well-trained topographer), can be surpassed in rapidity by any more complicated process which has yet been invented.

Possibly the discussion of the application of photography to this most important field of geographical survey may be reserved for a future volume, although it might certainly have been usefully included in the present one. The author is at any rate on perfectly sound ground when he recommends every explorer who makes use of photography for illustrative purposes to fix the position of his views and the direction (or azimuth) of them with careful exactness on his route map; with the assurance that in scientific hands they will prove of immense value in elucidating the topography of the country which they illustrate if they are thus registered.

There is no work in the English language equal to that of Colonel Laussedat as a comprehensive and up-to-date review of the history and development of topography; in the value of its scientific deductions and illustrations; or in the interest which is sustained by the literary skill exhibited. It should find a place in every library of civil or military engineering institutions which professes to maintain an efficient stock of standard works for reference.

T. H. H.

EUCLID REVISED.

Euclid's Elements of Geometry. Books i.-iv., vi. and xi. By Charles Smith, M.A., and Sophie Bryant, D.Sc. Pp. viii + 460. (London: Macmillan and Co., Ltd., 1901.) Price 4s. 6d.

IF Euclid is to continue as the foundation of geometrical teaching in our schools, this work must be very warmly welcomed. The exact order of Euclid is followed, but (as the editors inform us) with no special regard to the exact words of the translation of Simson (who for a moment becomes "Simpson" in the foot-note on p. 79). There is also a complete absence of the mechanical chopping up of each proposition into separate blocks under the heads of "general enunciation," "particular enunciation," "hypothesis," "construction," "to prove," "proof," "conclusion," which in some textbooks, and in the minds of many boys, has reduced the whole subject to an artificial jargon.